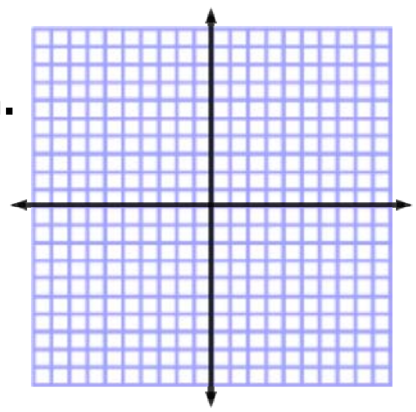
Warm -up 4-16

Graph the following quadratic function.

1. $y - 1 = 4x^2 + 8x$



For each quadratic, solve using the quadratic formula, find the axis of symmetry, and find the vertex of its graph.

2. $y = -2x^2 - 4$

3. $0 = x^2 + 8x + 16$

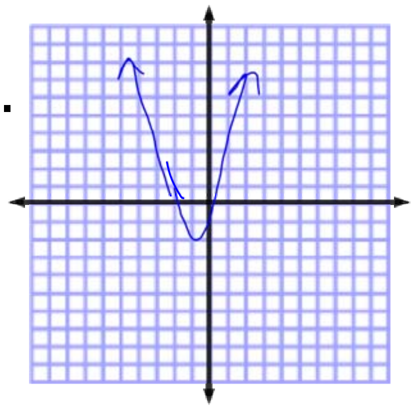
Warm-up 4-16

Graph the following quadratic function.

1. $y - 1 = 4x^2 + 8x$

$+1 \qquad +1$

$y = 4x^2 + 8x + 1$



For each quadratic, solve using the quadratic formula, find the axis of symmetry, and find the vertex of its graph.

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

2. $y = -2x^2 - 4$

$a = -2$
$b = 0$
$c = -4$

$x = \frac{-0 \pm \sqrt{0^2 - 4(-2)(-4)}}{2(-2)}$

$x = \frac{0 \pm \sqrt{-32}}{-4}$

x - no real solution

$x = \frac{-b}{2a} = \frac{-0}{2(-2)} = 0$

$x = 0$ (0, -4)

$y = -2(0) - 4$

$y = -4$

3. $0 = x^2 + 8x + 16$

$a = 1$
$b = 8$
$c = 16$

$x = \frac{-8 \pm \sqrt{8^2 - 4(1)(16)}}{2(1)}$

$x = \frac{-8 \pm \sqrt{0}}{2}$

$x = \frac{-8}{2} = -4$

$x = -4$

$x = \frac{-b}{2a} = \frac{-8}{2(1)} = -4$

$x = -4$ (-4, 64)

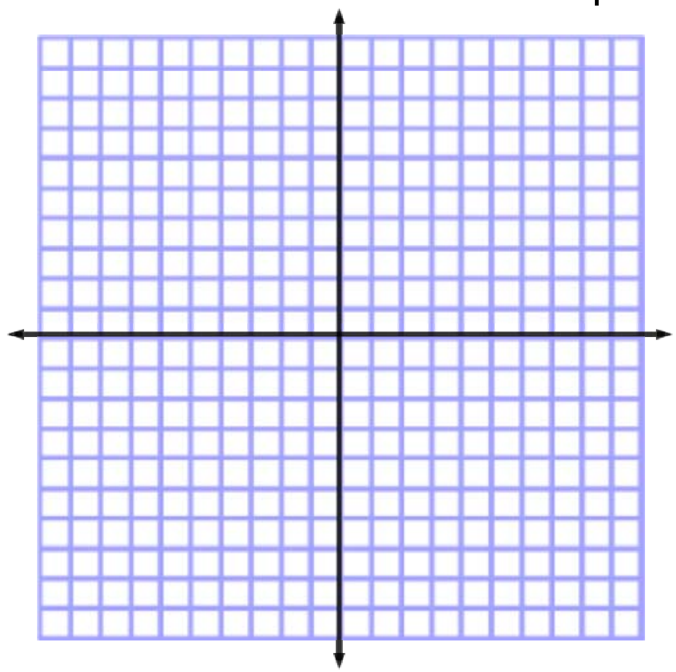
$(-4)^2 + 8(-4) + 16 = 64$

Graph the following functions on the same coordinate plane.

$f(x) = x^2$

$g(x) = x^2 + 3$

$h(x) = x^2 - 2$



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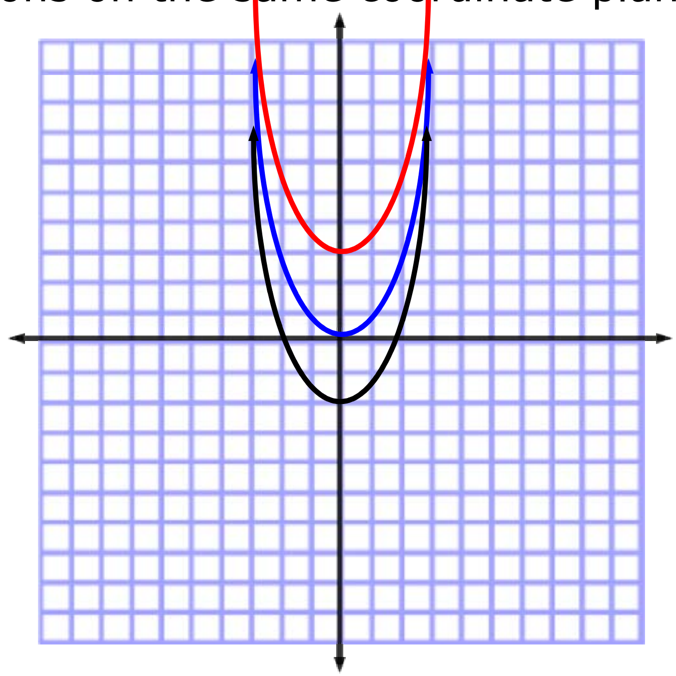


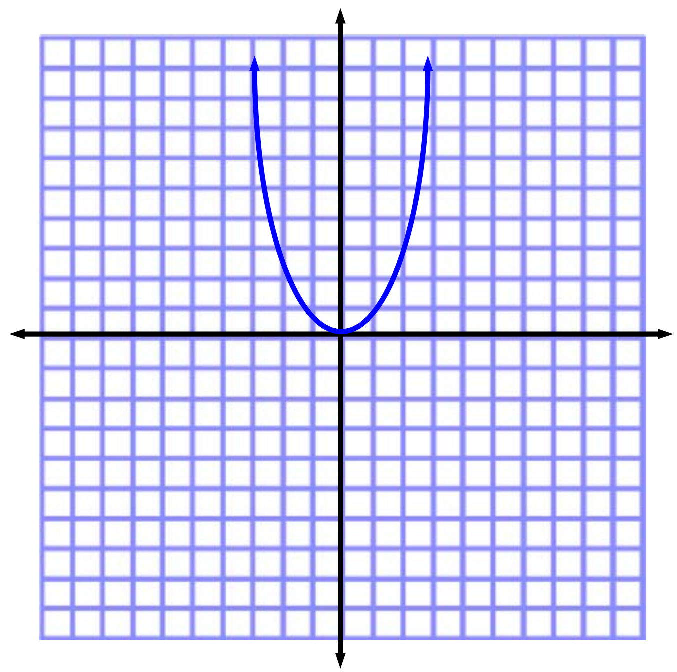
Today's Goal

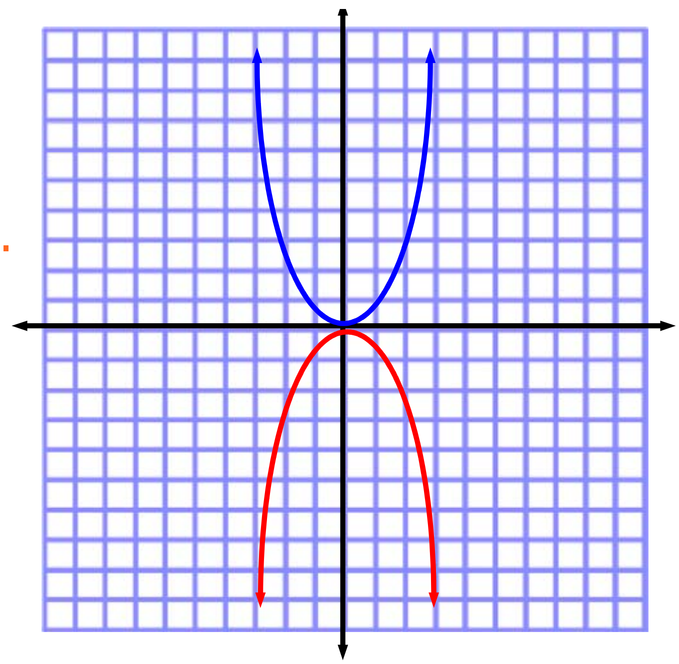
I can graph and transform quadratic functions.

Section 10.4: Transforming Quadratic Functions

Parent Function

$y=x^2$





Graph

$y = -x^2$

Compare to the parent function.

What changed from the parent function graph?

It reflected over the x-axis.

What changed from the parent function equation:

a became negative

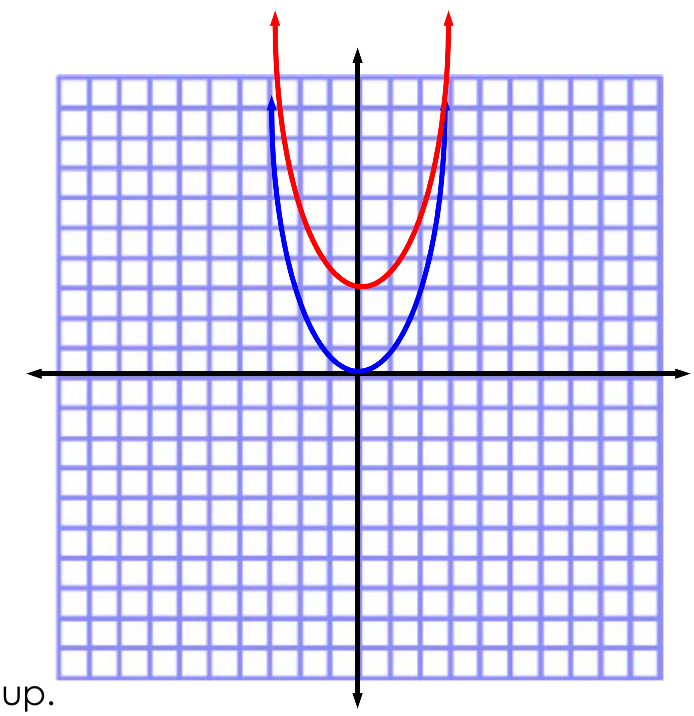
Conclusions:

Changing the sign flips the quadratic.

Transformation: reflection

Graph

$y = x^2 + 3$



What changed from the parent function graph?

It moved up 3 spaces.

What changed from the parent function equation:

It added 3 (c).

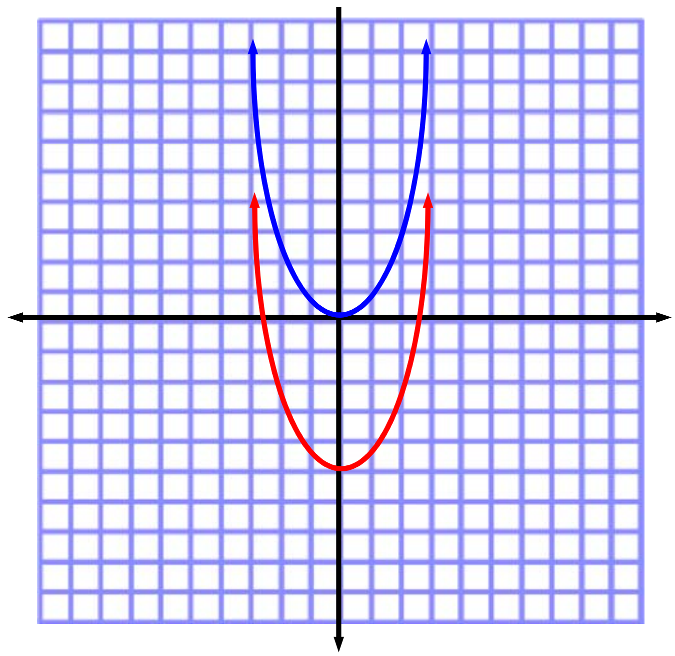
Conclusions:

Adding a positive c moved the graph up.

Transformation: Vertical shift up

Graph

$y = x^2 - 5$



What changed from the parent function graph?

It moved down 5 spaces.

What changed from the parent function equation:

They subtracted 5 (c).

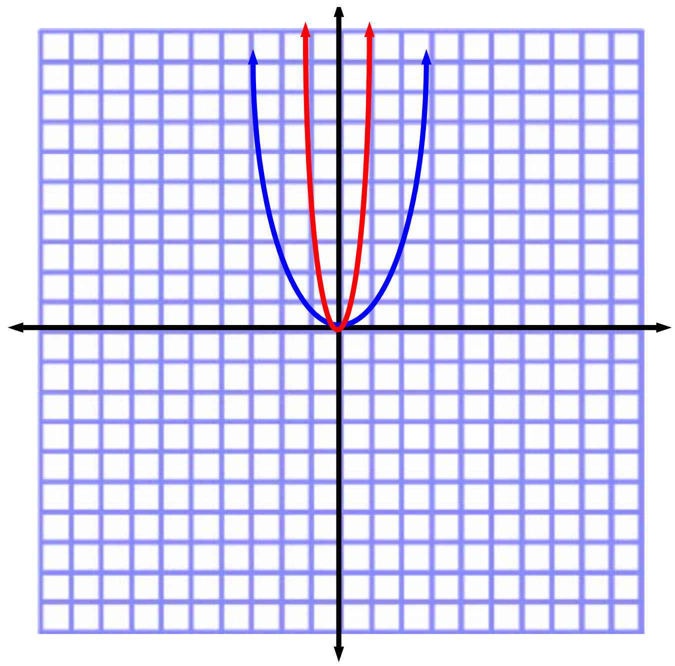
Conclusions:

When you subtract a positive c, the graph moves down.

Transformation: Vertical Shift down

Graph

$y = 8x^2$



What changed from the parent function graph?

It got narrower.

What changed from the parent function equation:

A was a whole number.

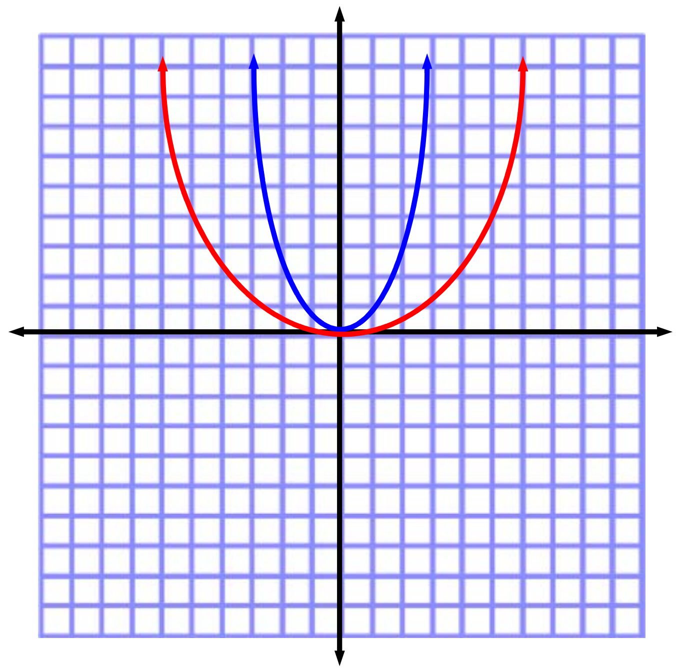
Conclusions:

When a is a whole number greater than 1, the graph gets narrower.

Transformation: Vertical stretch

Graph

$y = 1/4\ x^2$



What changed from the parent function graph?

The graph got wider.

What changed from the parent function equation:

a was a fraction.

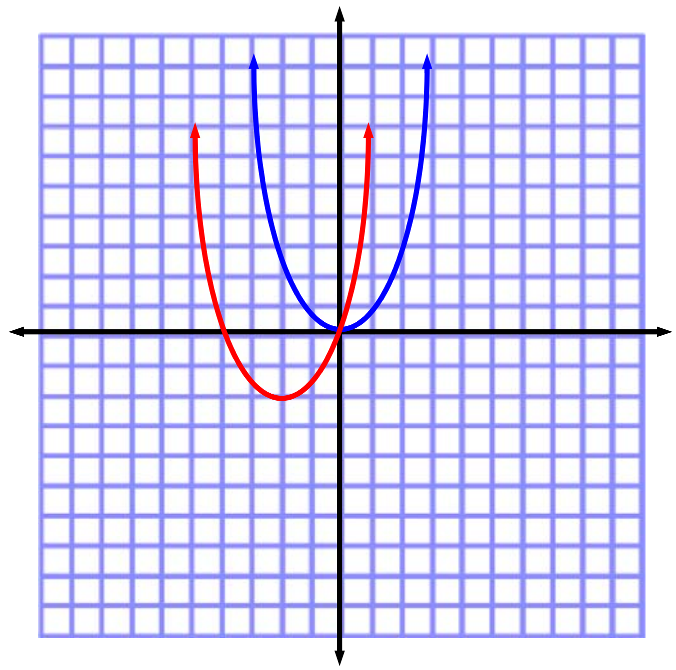
Conclusions:

When a is a fraction, it gets wider.

Transformation: Vertical shrink.

Graph

$y = x^2 + 4x$



What changed from the parent function graph?

It moved left/down.

What changed from the parent function equation:

We added a bx

Conclusions:

When you add a bx, it moves left/down or left/up

Transformation: Horizontal shift

Graph

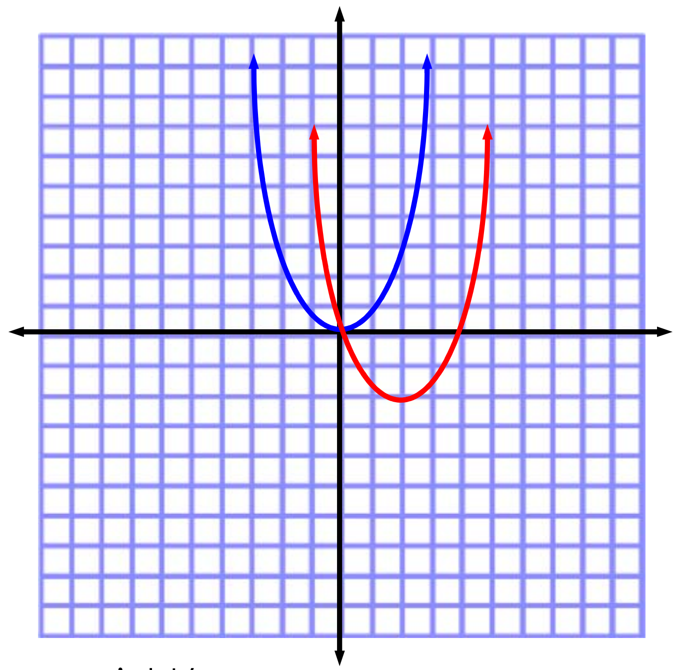
$y = x^2 - 4x$

What changed from the parent function graph?

It moved right/down.

What changed from the parent function equation:

We added a negative bx

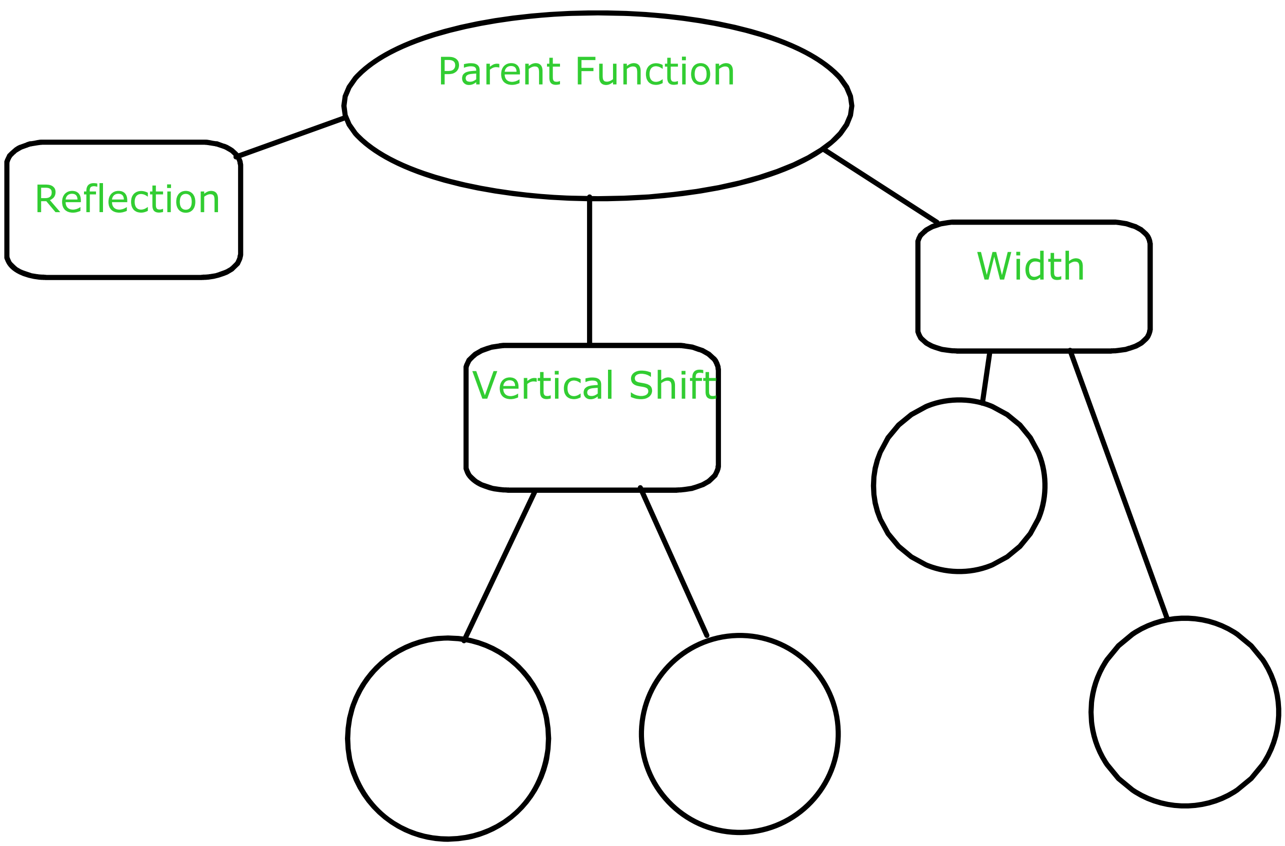


Conclusions:

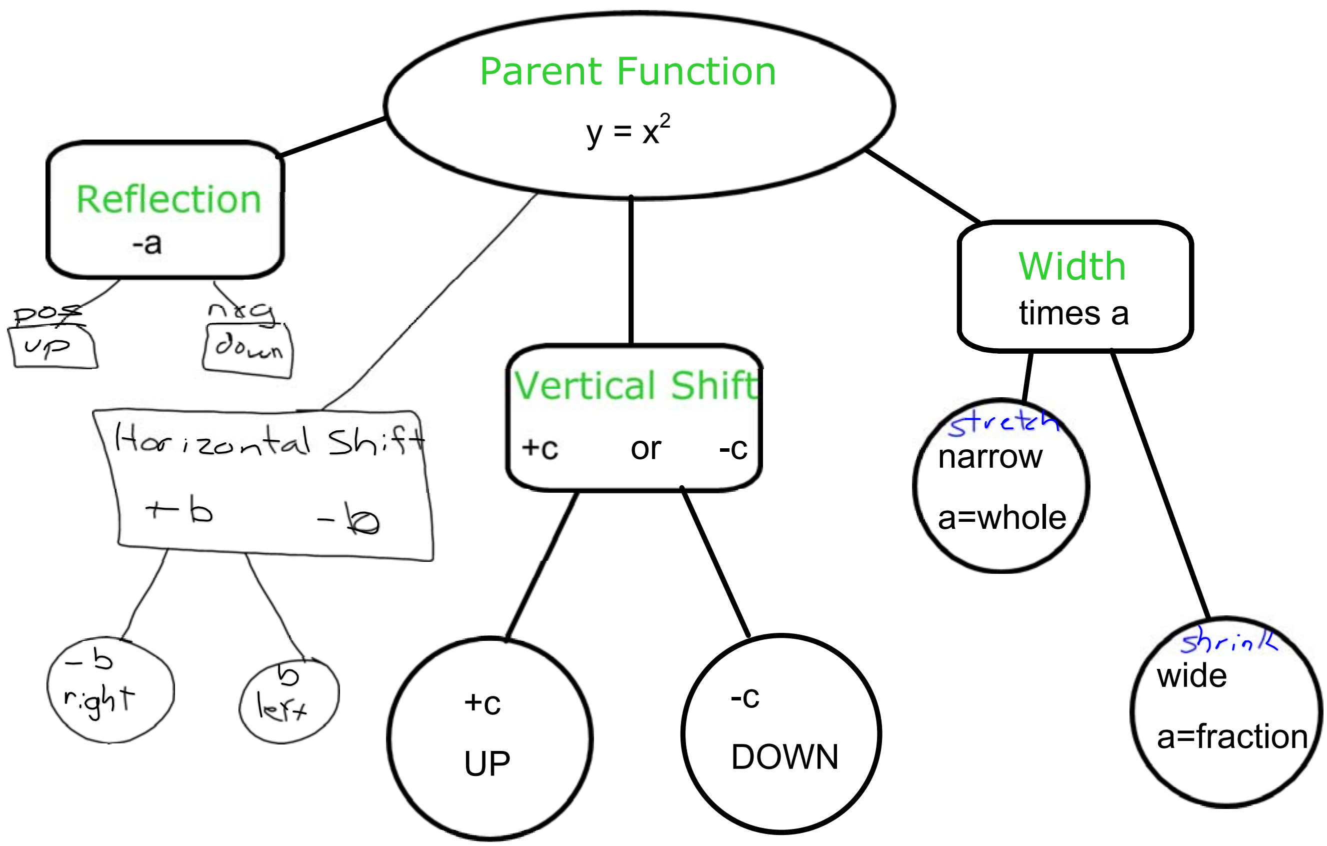
When you add a bx, it moves right/down or right/up

Transformation: Horizontal shift

Transformation Wrap-up



Transformation Wrap-up

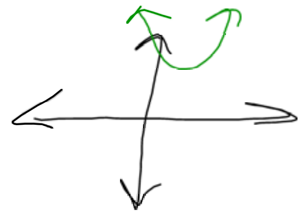


$y = \_x^2 - 3x + 16$

up (a is pos)

moved up 16

moves right

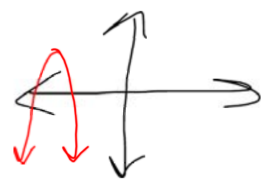


$f(x) = -4x^2 + 12x - 3$

down facing narrow (stretch)

left

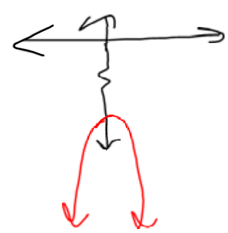
down 3 spaces



$g(x) = -2x^2 - 347$

down facing narrow (stretch

down 347



Before you leave...

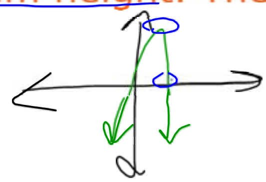
On the index card:

Describe how the graph $f(x) = x^2 + c$ differs from the graph of the parent function when the value of c is positive and when c is negative.

Tell how to determine whether a graph is wider or narrower by looking at the function.

Application

The height in feet of a football that is kicked can be modeled by the function $f(x) = -16x^2 + 64x$, where x is the time in seconds after it is kicked. Find the football's maximum height. Then find how long the football is in the air.



Step 1: Understand the problem

What is the answer going to include?

max (vertex)

2nd x-intercept

$-16(4)^2 + 64(4)$

$-256 + 256 = 0$

$x = 4$

4 seconds

64 ft

Important information:

calculator

$x = \frac{-b}{2a}$

$x = \frac{-64}{2(-16)} = 2$

Step 2: Make a plan

$-16(2)^2 + 64(2)$

$= 64$

What are we going to do?

find zeros

Step 3: Solve

Step 4: Look Back

Does this make sense?

Homework

Worksheet